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Department of Industrial Policy and Promotion

It is hereby certified that annexed here to is a true copy of **Indian Patent Specification** of the Patent application as granted and detailed below:-

Date Of Patent	:	**07/01/2004**
Patent No.	:	**201310 (12/CHE/2004)**
Patentee	:	**M/s. Wheels India Limited, Padi, Chennai – 600 050, an Indian Company.**

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Dated this the 8th day of September 2010
17th day of Bhadrapada, 1932(Saka)

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THE PATENTS ACT, 1970.

(39 of 1970)

COMPLETE SPECIFICATION

(See Section 10)

A METHOD OF MANUFACTURING INTEGRAL WHEEL RIM AND DISC ASSEMBLY OF A 5° TAPER BEAD-SEAT OF FLAT OR SEMI-DROP CENTER RIM AND INTEGRAL WHEEL CONSTRUCTION

WHEELS INDIA LIMITED
PADI, CHENNAI 600 050.

Nationality : Indian

The following specification particularly describes the nature of invention and the manner in which it is to be performed.

FIELD OF INVENTION

This invention in general relates to road wheels of vehicles. In particular this invention relates to construction of vehicle steel wheel of 5^0 taper bead-seat of flat or semi-drop center rim used but not limited for commercial use. This invention further relates to a method of manufacturing the said type of wheel.

The 5^0 taper bead-seat wheel tire bead seat area would have a 5^0 taper and profile (where tire contact is involved) as defined in the international tire and rim standards / manuals / hand books such as ETRTO, T&RA, JATMA. This is applicable for all 5^0 bead seat rims i.e. it includes semi drop center, flat base etc. Mainly this is for tube type application. It can be used as tubeless type only when a suitable sealing exists (as recommended by tire manufacturer). It has to be used along with the suitable removable flange / flanges (as recommended by wheel manufacturer) at the end/ends of the rim.

This invention relates to a construction, apparatus and a method of producing integral wheel rim and disc assembly of a 5^0 taper bead-seat of flat or semi-drop center rim, providing a generally circular steel blank from a sheet stock of pre-determined uniform thickness, the blank is preferably with a center hole pierced to a predetermined size. The blank is preformed in spinning machine to a predetermined cylindrical profile & shape, such perform is further spun and flow formed in a spinning machine, the preform being positioned between an outer roll & inner mandrel and held against the clamping plate, such inner mandrel comprise of a outboard surface which conforms to the predetermined inner diameter of the rim comprising of gutter portion, the well, the bead-seat and fixed flange and such outer roll comprise of outboard surface which confirms to the final shape and profile of the gutter wall. The preform peripheral cylindrical portion is then spun against the outboard surface of the inner mandrel & outboard surface of the outer roll to displace the material in backward & forward direction to the final profile and shape of the gutter wall and predetermined profile & form of well, bead-seat, fixed flange respectively. The spun rim comprising of gutter, well and bead seat is further spun and flow formed in a spinning machine, being positioned between an outer mandrel and an inner clamping plate, such outer mandrel comprise of a inboard surface which conforms to the final shape of the fixed flange and 5^0 angle to the bead-seat, is spun and flow formed against the inner surface of the outer mandrel by a shaping roller of predetermined shape to form the final shape of the fixed flange and 5^0 bead-seat

PRIOR ART

In its most conventional form, a fabricated sheet steel wheel of a 5^0 taper bead-seat of flat-base or semi-drop center rims for a vehicle, the rim inner periphery have welded or jointed central disc also made of sheet steel. The tire mounts on the outer periphery of the rim supported by the central disc, which provides a means of attachment to spindle hubs, brake drum or other like associated parts of the vehicle. It is essential that the rim and disc, in their assembled relationship, insure perfect roundness of the rim and accurate axial alignment of the rim with respect to the disc. Deviations in the respective directions being termed as "radial" and "axial" run-outs, the Vehicle manufacturers establish extremely rigid specifications in the tolerances for these dimensions.

When such wheels are manufactured in the conventional method, the rim and discs are normally made as separate components. These two components are then

assembled together in a press or in a fixture, the disc fixed at its outer peripheral flange to the inner periphery of the rim by welding or some other like method to form the complete wheel assembly. In the conventional method of making the rims by using a butt-welded hoop made out of a strip of hot rolled sections or plate, achieving such a close tolerance on the roundness has found to be extremely difficult due to the localized "kink" in the region of butt welded joint and the non-uniform spring back during the rim diameter-calibration operation. Likewise accurate dimensional control in making the disc are also found difficult due to cold press forming inconsistency, brought about by dimensional and properties variation of the input material. Further substantial distortion due to welding the two parts requires further corrective additional costly operation to ensure that the axial alignment is held within limits. It is appreciated by the people who are skilled in the manufacturing wheels that such distortion once occurred cannot be corrected completely and a welded assembly does not lend itself well to the rigorous balancing and centering of the wheel Such shift in the axial alignment and also the localized kink in the rim in the region of the butt welded joint is known to produce first harmonics during vehicle running causing vibration and high noise. The axial shift between the disc and the rim also produces imbalance of the wheel causing vehicle disturbance or thumping / shake.

Further when such wheels have been run with test overloads to induce failure, fatigue cracks have usually occurred in the center of the disc where it is attached to its supporting axle and in the welds, which have attached the rim to the disc.

Another problem of the wheel of conventional design is due to the constraint of using break drum of larger size. This is due to the disc peripheral portion being assembled under the rim, thus restricting space for accommodating a break drum of larger size. Today's vehicle carries more loads at high speed. From the point of view safety it is necessary to provide for a greater area for a larger envelope break components for improved breaking performance.

The use of integral wheel rim and disc assembly of a 5^0 taper bead-seat of flat or semi-drop center rims of low carbon and high strength steel, would lead to a noticeable reduction in weight, would facilitate balancing and centering.

It is well recognized that wheels are not only critical to the safety of an automotive vehicle but also being an un-sprung mass has a pronounced effect on vehicle stability and driving comfort. It is thus obvious that only an integral wheel rim and disc assembly of a 5^0 taper bead-seat of flat or semi-drop center rims construction and a method of manufacturing the same would satisfy the requirement as enumerated as above.

However, up to the present time, none of the prior processes has enabled to be produced a integral wheel rim and disc assembly of a 5^0 taper bead-seat of flat or semi-drop center rims construction under satisfactory technical and/or economic conditions, either on account of the fact that they do not lend themselves to mass production at an attractive cost price, or on account of the fact that the wheels obtained do not satisfy the requirements of the users, strength, minimal unbalance and first harmonic content, and accuracy of the significant dimensional characteristics.

The present invention relates to a apparatus and method for producing integral steel wheel rim and disc assembly of a 5^0 taper bead-seat of flat base or semi-drop center rims for vehicles, which lends itself particularly well to mass production and provides wheels which meet the requirements of users such as have just been enumerated above. A vehicle integral wheel rim and disc assembly of a 5^0 taper bead-seat of flat

or semi-drop center rims requires less material to construct and is substantially simpler to fabricate as there are fewer parts to construct and there are no assembly & welding steps involved, thus resulting in cost savings.

OBJECTS OF THE INVENTION

Accordingly, it is an object of the present invention to provide an integral steel wheel rim and disc assembly for vehicle wheel of 5^0 taper bead-seat of flat-base or semi-drop center construction, and an method and apparatus for making the same, which overcome the aforementioned problems in an economical and reliable manner.

It is another object of invention to provide an improved method of manufacturing of a vehicle wheel in a way that reduces manufacturing cost while providing high strength wheel

It is further object of invention to provide for a construction that reduces the wheel weight substantially, yet providing the high strength wheel.

It is yet another object of invention to provide for a greater air space for a larger envelope brake components for improved braking performance.

It is still another object of invention to provide for a wheel having very low radial and lateral run outs.

Yet another object of invention is to provide for a wheel having very low first harmonic content.

It is another object of invention to provide for a wheel having very low unbalance.

It is another object of invention to provide a method whereby a family of vehicle wheels having any plurality of axial width; diameter and offset may be produced from the blanks.

It is another object of invention to provide which would improve uniformity characteristics and increased fatigue life.

A further object is to provide improved apparatus of the aforementioned character, which is economical to set-up, and adjust.

Another object of the invention is to provide an improved manufacturing system, which requires only relatively small number of process steps, which can be carried out efficiently, and economically by automated equipment.

SUMMARY OF THE INVENTION

One aspect of the present invention is a unique cold forward & reverse spinning & flow forming method for manufacturing integral steel wheel rim and disc assembly for vehicle steel wheels of 5^0 taper bead-seat of flat-base or semi-drop center construction. Generally providing circular steel blank from a sheet stock of pre-determined uniform thickness, the blank is preferably with a center hole pierced to a predetermined size. The blank is preformed in a spinning machine to a predetermined profile & shape, such perform is further spun and flow formed in a spinning machine while the preform being positioned between an outer roll & inner mandrel and held against the clamping plate, such inner mandrel comprise of a outboard surface which conforms to the predetermined inner diameter of the rim comprising of gutter portion,

well, the bead-seat and fixed flange and such outer roll comprise of outboard surface which confirms to the final shape and profile of the gutter wall. The preform peripheral portion is then forward & revere spun against the outboard surface of the inner mandrel & outboard surface of the outer ring to a predetermined profile & form well, bead-seat, fixed flange and the final profile and shape of the gutter wall respectively. The spun rim comprising of gutter, well and bead seat is further spun and flow formed in a spinning machine, being positioned between an outer mandrel and an inner clamping plate, such outer mandrel comprise of a inboard surface which conforms to the final shape of the fixed flange and 5^0 bead-seat, is spun and flow formed against the inner surface of the outer mandrel by a shaping roller of predetermined shape to form the final shape of the fixed flange and 5^0 bead-seat.

Before backward & forward spinning of the preform, the preform is subjected to such operations where the central hole, mounting holes and the vent holes are pierced to a required size.

After final rim profiling & shaping operation, the center hole and the mounting holes are machined accurately.

The principal objects of the present invention are to provide a unique, low cost method of press forming, spinning & flow forming a integral wheel rim and disc assembly of a 5^0 taper bead-seat of flat or semi-drop center rims and the like. Steel blank is formed from sheet stock, and is spin and flow formed in a spinning operation to reduce manufacturing costs. The spinning & flow forming technique employs tools with a simple forming surfaces, which minimizes their associated manufacturing cost, as well as repair expenses. The spin forming machine can be easily programmed to form different shapes, such that the present method is especially suited for making specialty and/or low volume wheel designs as well as particularly well adapted for manufacturing one-piece type vehicle wheels for bulk manufacturing.

These and other advantages of the invention will be further understood and appreciated by those skilled in the art by reference to the following written specification, claims and appended drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawing is intended to provide further understanding of invention and is incorporated in and constitutes a part of invention. The drawings illustrate an embodiment of invention and together with the description illustrate principle of invention.

The drawings should not be taken as implying any necessary limitation on the essential scope of invention.

The drawings are given by way of non-limitative example to explain the nature of the invention.

For a more complete understanding of the instant invention reference is now made to the following description taken in conjunction with accompanying drawings.

The various feature of novelty which characterize the invention are pointed out specifically in the claims which a part of description. For a better understanding of the invention, its operating advantage, specific objects obtained by its use, reference

should be made to the drawings and descriptive matter is which there are illustrated and described preferred embodiments of invention.

Referring now to drawings, where like numerals designate identical or corresponding parts throughout the referred views.

Fig 1 – shows sectional view of a disc blank of the welded 5^0 taper bead-seat of flat-base or semi-drop center construction wheel of the prior art.

Fig 2 - shows sectional view of a formed disc of the welded 5^0 taper bead-seat of flat base or semi-drop center wheels of the prior art.

Fig 3 – shows sectional view of a disc with mounting, central and vent holes of the welded 5^0 taper bead-seat of flat base or semi-drop center wheels of the prior art.

Fig 4 – shows a schematic representation the welded hoop from flat plate for the manufacture of rims for welded 5^0 taper bead-seat of flat base or semi-drop center wheels of the prior art.

Fig 5 - shows a schematic representation the welded hoop from mill section for the manufacture of rims for welded 5^0 taper bead-seat of flat base or semi-drop center wheels of the prior art.

Fig 6 - shows a schematic representation the rolling operation involved in producing rims for welded 5^0 taper bead-seat of flat base or semi-drop center wheels of the prior art

Fig 7 - shows a schematic representation the calibration process steps involved in producing rims for welded 5^0 taper bead-seat of flat base or semi-drop center wheels of the prior art

Fig 8 - shows a schematic representation the assembled disc & rim & welded 5^0 taper bead-seat of flat base or semi-drop center wheels of the prior art.

Fig 9 – Shows a sectional view of disc steel blank with center hole of the one-piece steel wheel for producing integral wheel rim and disc assembly of a 5^0 taper bead-seat of flat or semi-drop center rim in accordance with the present invention.

Fig 10 – shows a schematic representation of the first stage of spinning process of the producing integral wheel rim and disc assembly of a 5^0 taper bead-seat of flat or semi-drop center rim in accordance with the present invention.

Fig 11 – shows a schematic representation of the spun wheel from the previous step, wherein the mounting and center hole is pierced in accordance with the present invention.

Fig 12 - shows a schematic representation of the spun wheel from the previous step wherein the vent holes are pierced in accordance with the present invention.

Fig 13 - shows a schematic representation of the second stage of shows a schematic representation of the second stage of forward and backward displacement of material during spinning process of producing integral wheel rim and disc assembly of a 5^0 taper bead-seat of flat or semi-drop center rim in accordance with the present invention

Fig 14 – shows a schematic representation of the final stage of spinning process of producing integral wheel rim and disc assembly of a 5^0 taper bead-seat of flat or semi-drop center rim where the bead-seat and fixed flange are formed to the final profile and shape in accordance with the present invention

Fig 15 – shows schematic representation of the spun wheel from the previous step, wherein the fixed flange edges are machined.

Fig 16 - shows a perceptive view of the one-piece steel wheel of integral wheel rim and disc assembly of a 5^0 taper bead-seat of flat or semi-drop center rim in accordance with the present invention.

DETAILED DESCRIPTION OF THE PRIOR ART AND THE PREFERRED EMBODIMENTS

The steps involved in the manufacture of steel discs are blanking of the circular blank of pre-determined thickness, press-forming and piercing the center hole, mounting and vent holes as shown in Fig 1, Fig 2 and Fig 3.

The conventional method of producing the steel wheel is shown in Fig 1 to Fig 8. In the conventional method the disc and the rim are manufactured as separate components then welded or jointed by other means after assembly.

The rim is manufactured either by using a flat plate of uniform thickness or using the profiled hot rolled plate as shown in Fig 4 and Fig 5. In either case the plate is coiled into a hoop, but welded, joint trimmed and dressed. In the case of flat plate, the profile of the rim is achieved using press or spinning operations either hot or cold. Finally the rims are roll formed & calibrated for the diameter and out-of roundness accuracy as shown in the Fig 6 and Fig 7.

The finished discs and the rims are assembled in a press or a fixture and the joints are welded or jointed by other means after assembly. The wheels subsequently under goes several machining steps to machine center spigot and bolt hole as shown in Fig 8.

PREFERRED EMBODIMENTS OF THE INVENTION

Our preferred embodiment of invention is shown in Fig 9 to Fig 15. The following description is of the best presently contemplated mode of carrying out the invention. This description is made for the purpose of illustrating the general principles of the invention and should not be taken in a limiting sense. The scope of the invention is best determined by reference to the appended claims

The first step of manufacturing a integral steel wheel rim and disc assembly for 5^0 taper bead-seat of flat base or semi-drop center steel wheels involves a spinning and flow forming operation as shown in Fig 10, where in the steel blank of pre-determined diameter and thickness, the blank is preferably with a center hole pierced to a predetermined size, is spun and flow formed in a CNC 4-axis spinning machine to an predetermined shape. The operation is now explained in greater detail. The blank is held between inner mandrel M1 and the clamping plate C1. The roller R1 mounted on CNC hydraulically actuated slide, impart rolling pressure on the outer peripheral of the blank to reduce the thickness and at the same time give predetermined cylindrical shape and profile to the blank as per the predefined machine program. The outboard

surface of the inner mandrel M1 corresponds to the predetermined inner diameter of rim portion.

The next involves piercing mounting, central and vent holes as shown in the Fig 11 & Fig 12.

The next step involve forward & backward spinning to extend the cylindrical portion of the perform from the first step to an cylindrical shape of predetermined inner diameter and width comprising of gutter region, well and the fixed flange as shown in Fig 13 and at the same time cylindrical portion comprising of gutter region is backward spun as shown to a predetermined inner diameter and width. The operation is now explained in greater detail. The preformed blank as shown in Fig 12, is spun and flow formed in a CNC 4-axis spinning machine. The preformed blank is positioned between inner mandrel M2 and outer roll R2 and clamped prior to spinning operation by the clamping plate C2. The roller R2 mounted on CNC hydraulically actuated slide impart rolling pressure on the outer peripheral of the preformed blank to reduce the thickness at the required region and at the same time extend the cylindrical portion to a predetermined shape and profile as per the predefined machine program. The outboard surface of the inner mandrel M2 corresponds to the predetermined inner diameter of the rim. The next sequence is the backward displacement of material during spinning operation. The perform cylindrical portion comprising of the gutter portion is spun against an outer roll S2, such outer roll outboard surface corresponding to the predetermined shape of the gutter profile. The roller R2 is used for both forward and backward displacement of material as shown in the drawing.

The next and the final step involve profiling the fixed flange portion as shown in Fig 14. The spun rim from previous step comprising of gutter, well and bead seat is further spun and flow formed in a spinning machine, being positioned between an outer mandrel and clamped with an inner clamping plate, such outer mandrel comprise of a inboard surface which conforms to the final shape of the fixed flange and 5^0 bead-seat, is spun and flow formed against the inner surface of the outer mandrel by a shaping roller of predetermined shape to form the final shape of the fixed flange and 5^0 bead-seat. The operation is explained in a greater detail. The preformed blank from previous step comprising of gutter, well and bead seat is positioned between outer mandrel S3 and clamped with an inner clamping plate C3. The roller R3 mounted on CNC hydraulically actuated slide impart rolling pressure on the inner peripheral of the preformed blank to reduce the thickness at the required region and at the same time extend the cylindrical portion to a predetermined shape and profile as per the predefined machine program to the final profile & shape of the 5^0 bead-seat & fixed flange.

SALIENT FEATURES OF THE INVENTION ARE AS FOLLOWS:

A design / construction of a integral steel wheel rim and disc assembly for 5^0 taper bead-seat of flat base or semi-drop center wheels of the type having an integral disc and rim portion with gutter, well, 5^0 taper bead-seat and the fixed flange.

A method of producing the wheel consists in, providing generally circular steel blank; spinning the blank to of pre-determined uniform thickness and size. The blank is preferably with a center hole pierced to a predetermined size. The blank is preformed in a spinning operation, such perform further forward & reverse spun in a spinning machine, being positioned between an mandrel, outer roll and the clamping plate, such inner mandrel having a outboard surface which conforms to the cylindrical predetermined shape of the rim gutter, well, fixed flange & such outer roll have an

outboard surface corresponding to the gutter profile. The spun perform inner peripheral portions is spin and flow formed against the surface of the inner mandrel to form the final shapes of the rim 5^0 bead seat and flange.

The method has the step of spin forming the peripheral portion of the blank by engaging the same with a forming roller so as to obtain controlled thickness reduction and shape in the peripheral portion of the blank.

The method has the step of backward spinning a section of the blank peripheral portion against the shaping surface of an outwardly positioned roll to form the final shape of the rim gutter.

The method has the step of spin forming a section of the blank peripheral portion by engaging the same with a forming roller to form the final shape of the well base shape and dimension and at least a portion of the bead seat.

The method has the step of spin forming the bead seat portion of the blank inboard section against the shaping surface of the outer mandrel to form the final shape of fixed flange.

A method has the step wherein first-named spin forming step includes a plurality of passes of the forming roller.

A method has the step wherein after finish spinning operation bolt holes on pierced in a conventional press.

A method has the step wherein after piercing the bolt holes, vent holes are pierced in a conventional press

The method also includes the step of providing a disc blank of substantially uniform thickness and constructed HSLA steel composition.

Throughout this detailed description, reference is made to the tools and dies that perform the various shaping operations. Because the toolings used in each of the shaping operations are conventional devices, which are well known in the metal stamping/forming arts, detail description of the same has not been provided.

It is to be understood that the invention may assume various alternative orientations and step sequences, except where expressly specified to the contrary. It is also to be understood that the specific devices and processes illustrated in the attached drawings, and described in the following specification are simply exemplary embodiments of the inventive concepts defined in the appended claims. Hence, specific dimensions and other physical characteristics relating to the embodiments disclosed herein are not to be considered as limiting, unless the claims expressly state otherwise.

Further, since numerous modifications and changes will readily occur to those skilled in the art, it is not desired to limit the invention to the exact construction and operation shown and described, and accordingly all suitable modifications and equivalents may be regarded as falling within the scope of the invention as defined by the claims that follow.

WE CLAIM

1. A method of manufacturing a integral steel wheel rim and disc assembly for 5^0 taper bead-seat of flat base or semi-drop center wheels of the type having an integral disc and rim portion with gutter, well, 5^0 bead-seat and fixed flange wherein the said method comprises the following steps

    a) Providing a generally circular blank;

    b) The blank is preferably of pre-determined uniform thickness

    c) The blank is preferably with a center hole pierced to a predetermined size.

    d) Preforming the blank to predetermined shape & size, the preform blank is spun & flow formed in a CNC spinning machine, being positioned between a inner mandrel and clamping plate, such mandrel having a outboard surface of predetermined cylindrical shape confirming to predetermined cylindrical shape & profile of the rim gutter, well and fixed flange.

    e) The spun and flow formed preform to an predetermined cylindrical shape & size is further spun in a CNC spinning machine to reduce thickness consequently to increase the width in the forward direction to an predetermined size while maintaining the predetermined inner diameter wherein the well, bead seat and the fixed flange are formed in the subsequent operations and at the same time further spinning is preformed on the peripheral portion of the cylinder to displace the preform cylindrical peripheral portion in the backward direction, against the outboard surface of the inner mandrel & outboard surface of the outer ring to a predetermined profile & form of well, bead-seat, fixed flange and the final profile and shape of the gutter wall respectively.

    f) The spun preform comprising of finished gutter profile, and cylindrical portion comprising of predetermined shape of the well, bead seat & fixed flange is further spun and flow formed in a spinning machine, the perform being positioned between an outer mandrel and an inner clamping plate, such outer mandrel comprise of a inboard surface which conforms to the final shape of the fixed flange and 5^0 angle bead-seat, is spun and flow formed against the inner surface of the outer mandrel by a shaping roller of predetermined shape to form the final shape of the fixed flange and 5^0 bead seat.

2. The method as claimed in claim 1 wherein spin forming the peripheral & inner portion of the blank by engaging the same with a forming roller so as to obtain controlled thickness reduction and shape in the peripheral and inner portion of the blank.

3. The method as claimed in claim 1 wherein the material is displaced in the backward direction during spinning a portion of the perform peripheral cylindrical portion against the outboard surface of an outwardly positioned roll to form the final shape of the rim gutter.

4. The method as claimed in claim 1 wherein spin forming an section of the blank peripheral portion by engaging the same with a forming roller to form the final shape of the well base shape and dimension and at least a portion of the bead seat.

5. The method as claimed in claim 1 wherein spin forming the bead seat portion of the blank outboard section against the shaping surface of the outer mandrel to form the final shape of bead seat & fixed flange.

6. The method as claimed in claim 1, wherein: said first-named spin forming step consists a plurality of passes of the forming roller.

7. The method as claimed in claim 1 wherein after first step of spinning operation, boltholes are pierced in a conventional press.

8. The method as claimed in claim 1 wherein after piercing the bolt holes, vent holes are pierced in a conventional press

9. The method as claimed in claim 1 wherein said step (a) consists the step of providing a disc blank of substantially uniform thickness of low carbon steel or HSLA steel composition.

10. The method as claimed in claim 1 wherein a butt-welded hoop of predetermined diameter, width and thickness can also be used instead of a blank.

11. The method as claimed in 10 wherein the butt-welded hoop of predetermined diameter, width and thickness can also be used to manufacture the rim part alone.

12. Apparatus for manufacturing a integral steel wheel rim and disc assembly for 5^0 taper bead-seat of flat base or semi-drop center wheels of the type having an integral disc and rim portion with gutter, well-base, bead-seat and fixed flange wherein the said method comprises means for providing a generally circular blank means for forming the blank to of pre-determined uniform thickness the blank is preferably with a center hole pierced to a predetermined size, the blank is pre-formed in a conventional press, the pre-form blank further spun in a spinning machine, being positioned between an mandrel having a surface which conforms to the final shape of the rim gutter, well, fixed flange and the clamping plate, the blank peripheral & inner portions is spun and flow formed against the surface of the inner or outer mandrel to form the final shapes of the rim gutter, well and the inboard bead seat and flange.

13. Apparatus for manufacturing a integral steel wheel rim and disc assembly for 5^0 taper bead-seat of flat base or semi-drop center wheels for a vehicle having an integral disc and rim portion with gutter, well base, bead-seat and fixed flange manufactured by the process claimed in claim 1.

14. A integral steel wheel rim and disc assembly for 5^0 taper bead-seat of flat base or semi-drop center wheels for a vehicle having an integral disc and rim portion with gutter, well-base, bead-seat and fixed flange wherein when spin forming machine is programmed to form different shapes.

15. A method of manufacturing a integral steel wheel rim and disc assembly for 5^0 taper bead-seat of flat base or semi-drop center wheels for a vehicle having an integral disc and rim portion with gutter, well-base, bead-seat and fixed flange as

described in the description of complete specification and as illustrated by way of drawings accompanying the complete specification.

16. A integral steel wheel rim and disc assembly for 5^0 taper bead-seat of flat base or semi-drop center wheels for a vehicle having an integral disc and rim portion with gutter, well-base, bead-seat and fixed flange as described in the description of complete specification and as illustrated by way of drawings accompanying the complete specification.

Dated this the 7th day of January 2004.

For WHEELS INDIA LIMITED

S. Srivatsan
VICE PRESIDENT (FINANCE) & SECRETARY

Signature of Applicant

ABSTRACT

This invention relates to a construction, apparatus and a method of producing integral wheel rim and disc assembly of a 5^0 taper bead-seat of flat or semi-drop center rim, providing a generally circular steel blank from a sheet stock of pre-determined uniform thickness, the blank is preferably with a center hole pierced to a predetermined size. The blank is preformed in spinning machine to a predetermined profile & shape, such perform is further spun and flow formed in a spinning machine, the preform being positioned between an outer roll & inner mandrel and held against the clamping plate, such inner mandrel comprise of a outboard surface which conforms to the predetermined inner diameter of the rim comprising of gutter portion, the well, the bead-seat and fixed flange and such outer roll comprise of outboard surface which confirms to the final shape and profile of the gutter wall. The preform peripheral portion is then forward & revere spun against the outboard surface of the inner mandrel & outboard surface of the outer roll to a the final profile and shape of the gutter wall and predetermined profile & form of well, bead-seat, fixed flange respectively. The spun rim comprising of gutter, well and bead seat is further spun and flow formed in a spinning machine, being positioned between an outer mandrel and an inner clamping plate, such outer mandrel comprise of a inboard surface which conforms to the final shape of the fixed flange and 5^0 angle to the bead-seat, is spun and flow formed against the inner surface of the outer mandrel by a shaping roller of predetermined shape to form the final shape of the fixed flange and 5^0 bead-seat

NAME OF THE APPLICANT: WHEELS INDIA LIMITED

Application No. 0012/CHE/04

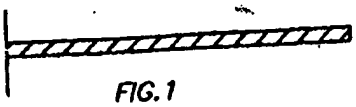

FIG.1

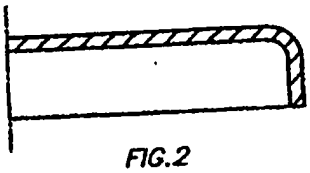

FIG.2

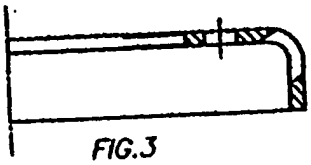

FIG.3

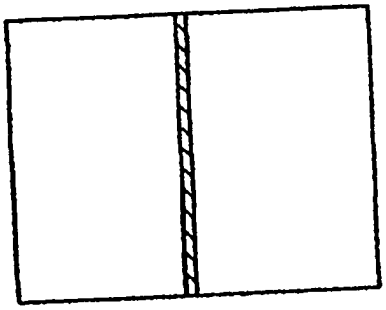

FIG.4

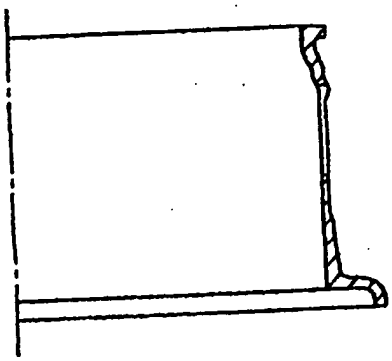

FIG.5

PRIOR ART

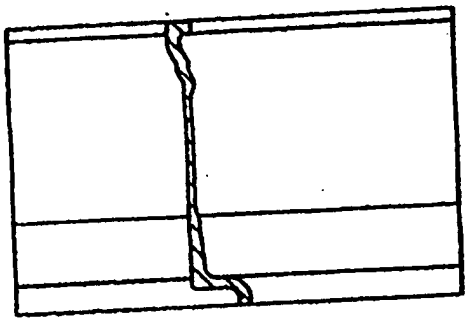

FIG.6

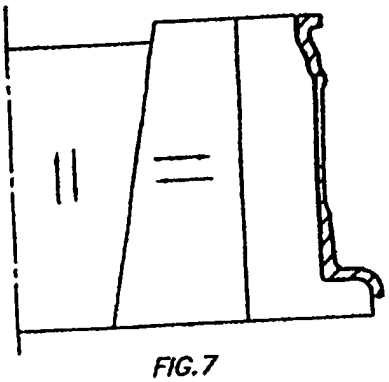

FIG.7

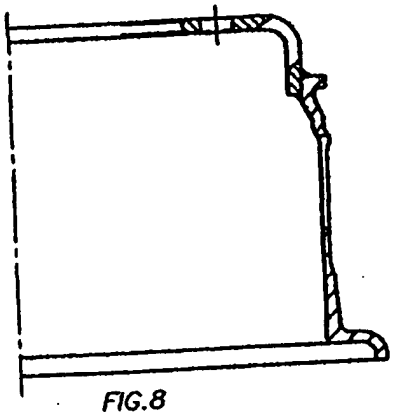

FIG.8

5° TAPER BEAD SEAT FLAT OR SEMI DROP CENTRE WHEELS.

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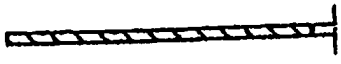

FIG.9

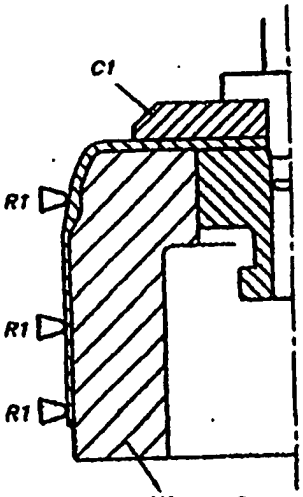

FIG.10

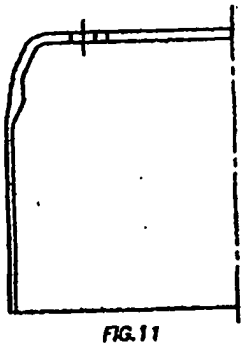

FIG.11

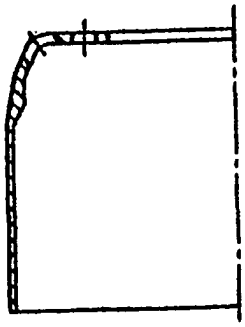

FIG.12

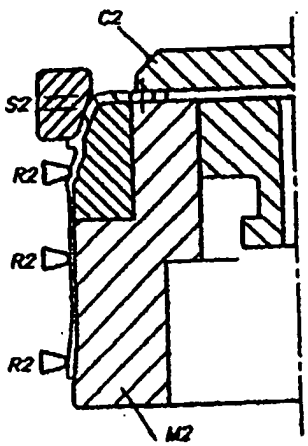

FIG.13

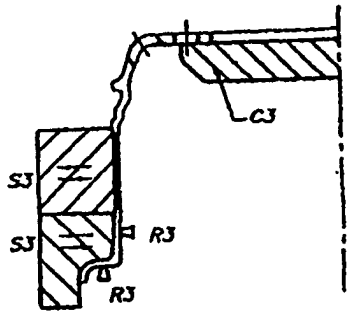

FIG.14

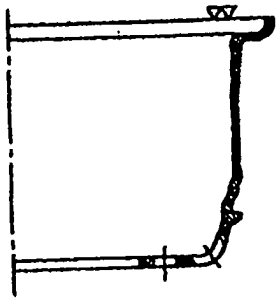

FIG.15

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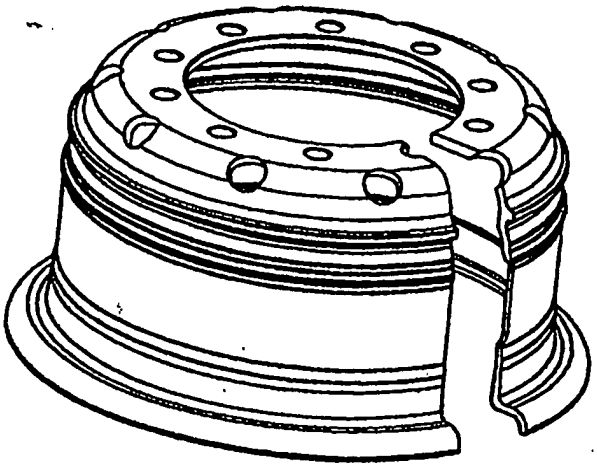

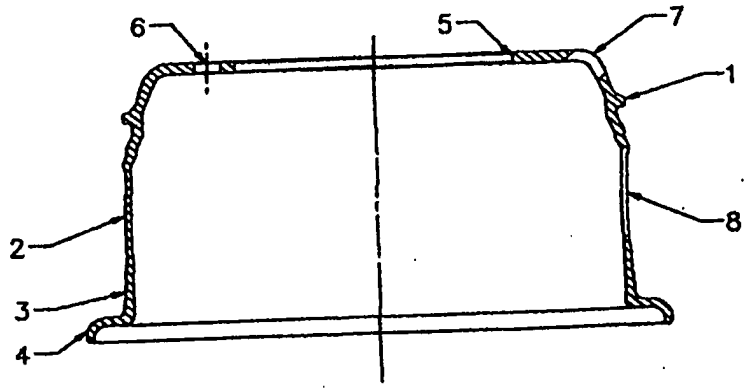

FIG.16

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